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GENERAL SCANNING INC.

AUG. 1972

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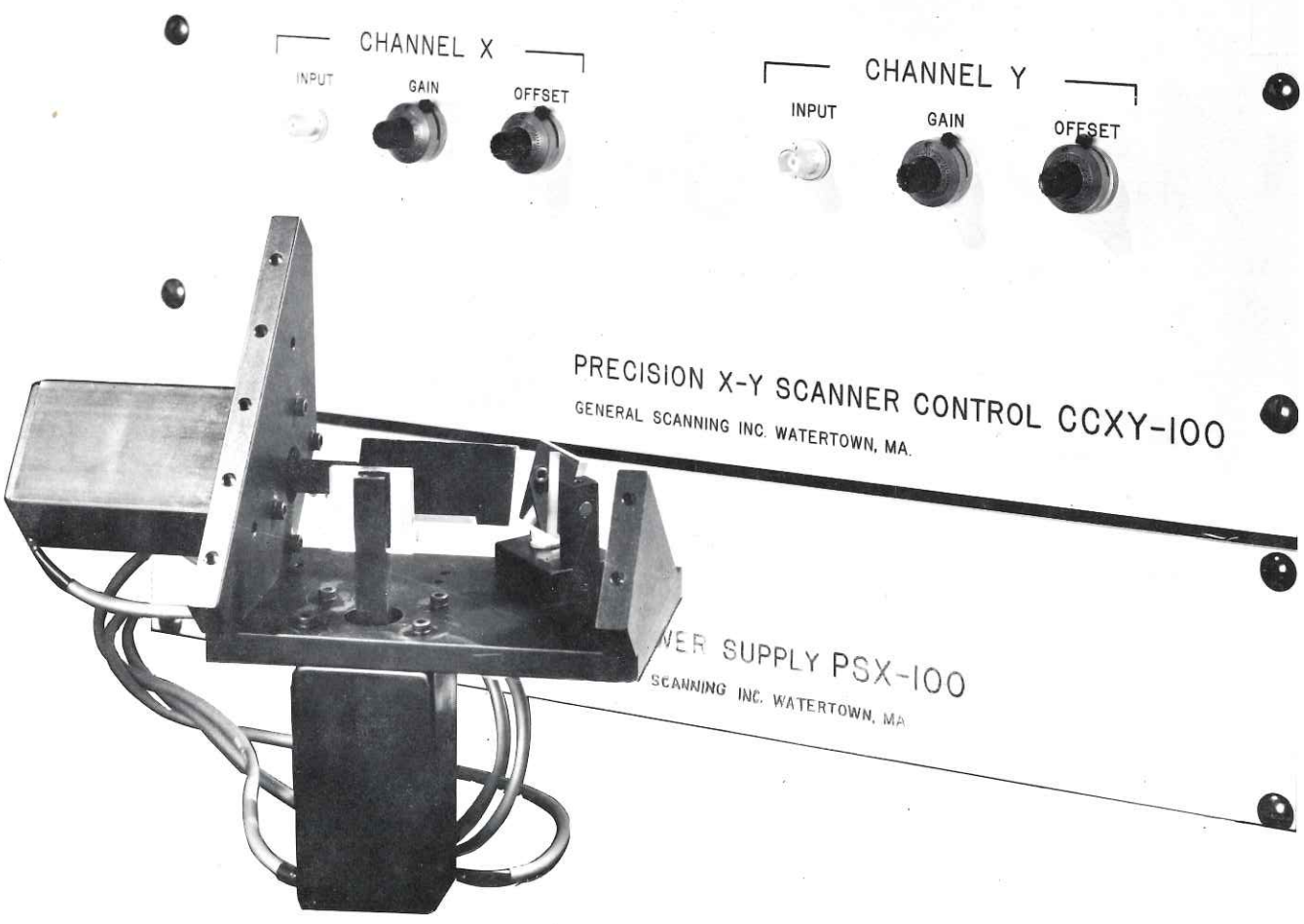
SERIES 300

SERVO ACTUATED OPTICAL SCANNERS



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applications

- LASER RESISTOR-TRIMMING
- MACHINING
- MICROCIRCUIT MASK GENERATION
- X-Y PLOTTING

general description

The Series 300 Servo-Actuated Optical Scanners consist of scanners of the G-300 type (See Bulletin "Optical Scanners/ Series G), modified to include a position transducer, and of suitable loop-closing electronics.

The servo-actuated scanners permit highly accurate and fast control of mirror position within a range of 30 degrees of mechanical rotation.

The position transducer is a variable capacitance bridge, manufactured under license, with a linearity better than 0.2%, a discrimination of one second of arc, and a 10 microsecond time constant.

The loop-closing electronics are designed to provide an optimum combination of accuracy and response time. Typically the frequency response is flat to over 200 Hz, and mirrors 1" x 2" in size can be stepped within 1/1000 of step amplitude in less than 20 milliseconds.

Figure 1 shows the response of a scanner driving 1 inch diameter mirror through an angular step of 20° (time scale: 5 milliseconds/division).

Figure 2 shows the response of the same scanner to an abrupt velocity change of 500 degrees/sec (triangular wave scanning). The time to reach within 1/1000 of ramp amplitude is approximately 5 milliseconds (time scale: 10 milliseconds/ division).

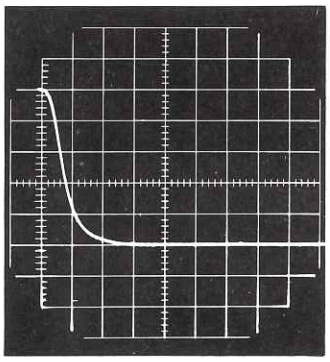

Figure 1.

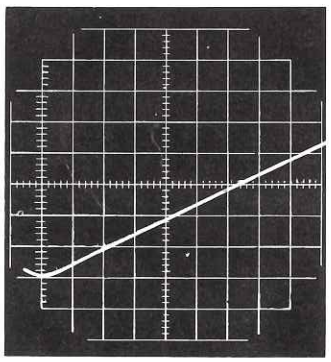

Figure 2.

The product line offers the components of both single-axis and two-axis servo-actuated scanning systems in any desired combination.

basic servo configuration

The servo loop design is shown in Figure 3. The position signal is compared to the desired value, and it is also differentiated. The position error is fed to a first-order lag network, and the resulting signal is summed with the rate signal of the differentiator. The sum signal is then amplified and fed to the drive coil of the scanner. In the actual circuits, the time constant of the differentiator and the lag networks as well as the amplifier gain are independently adjustable.

The lag plays an important role in overcoming the de-stabilizing effect of the inductance of the drive coils of the scanner.

The operations indicated in Figure 3 are accomplished in three separate circuits: 1) a position signal circuit, PD-100 or PD-200, which converts the current produced by the position transducer to a voltage of suitable amplitude; 2) a control circuit, CC-100, which performs the low-level signal operations shown in Figure 3; and 3) a driver amplifier, A-100C. These circuits are all powered from a common dc Power Supply, available separately.

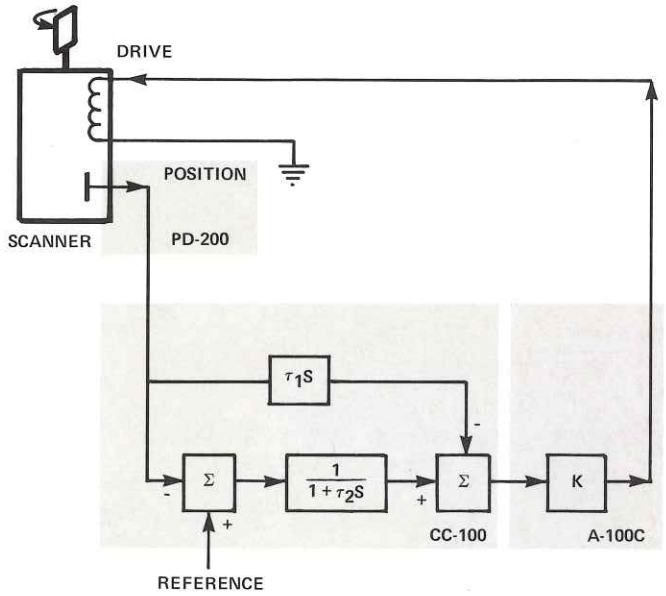

Figure 3. Servo Loop Design

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specifications

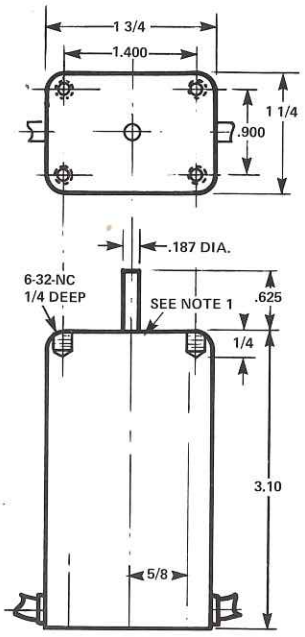
G-300 PD OPTICAL SCANNER

TORQUE DRIVER (coils wired in series)

Torque sensitivity	0.14 newton-meter/ampere
Maximum torque	0.3 newton-meter
Armature inertia	3.7×10^{-7} Kg-m^2
Stiffness	0.1 newton-meter/radian
Coil resistance	8 ohms
Coil inductance	0.02 Henry

POSITION TRANSDUCER

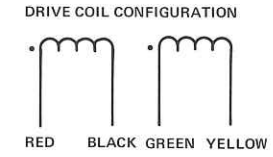
Position sensitivity (differential)	8 mA/radian
Signal rise-time	10 microseconds
Linearity	0.2% of peak-to-peak deflection or better
Range	30° peak-to-peak
Stability	0.02% per degree C
Supply voltage	+ 12 VDC, regulated

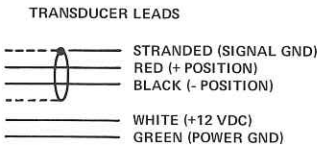


NOTE 1:
MOUNTING SURFACE IS SQUARE WITH AXIS OF ROTATION TO 1/1000 RADIAN.

NOTE 2:
SIGNAL AND POWER GROUNDS ARE CONNECTED TOGETHER IN SCANNER. BEWARE OF GROUND LOOPS!

LENGTH OF CABLE CONNECTIONS: 9 in.
WEIGHT: 20 oz.
FINISH: BLACK ANODIZING





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PD-100 POSITION SIGNAL CIRCUIT

The PD-100 circuit is a *single-ended* transconducting amplifier, mounted on a plug-in PC board. When used, either the red or the black lead from the position transducer of the G-300 PD scanner is connected to signal ground.

Position output sensitivity	0.7 volt/degree
Output range	± 11 VDC
Supply voltage	± 15 VDC, 20 mA, regulated
Connections	10-Pin PC board edge connector (0.156" centers)
Size	2.5 x 5 inches

PD-200 POSITION SIGNAL CIRCUIT

The PD-200 circuit is a *differential* transconducting amplifier, mounted on a plug-in PC board. The differential design and the components used are intended to provide high output stability. Three models, with different position output sensitivities are available:

MODEL	POSITION OUTPUT SENSITIVITY
PD-203	0.3 volt/degree
PD-215	1.5 volts/degree
PD-275	7.5 volts/degree

For all models:

Output range	± 11 VDC
Supply voltage	± 15 VDC, 60 mA, regulated
Connections	10-Pin PC board edge connector (0.156" centers)
Size	2.5 x 5 inches

CC-100 CONTROL CIRCUIT

Differentiator time constant	0 to 7 ms
Lag time constant	0 to 6 ms
Reference input range	± 10 VDC
Supply voltage	± 15 VDC, 80 mA, regulated
Connections	10-Pin PC board edge connector (0.156" centers)
Size	2.5 x 5 inches

A-100 C AMPLIFIER

Voltage gain	0 to 10
Supply voltage	±15 VDC, 2 A, regulated
Connections	10-Pin PC board edge connector (0.156" centers)
Heat sink	with 8-32 screw to chassis
Size	2.5 x 5 inches

CCX-100 CONTROLLER

Includes circuits PD-200, CC-100 and A-100 in an enclosure with input gain and offset controls.

Input voltage range	±10 VDC
Input voltage offset	0 to -5 VDC
Input voltage gain adjust range	5 to 1
Power input	±15 VDC, 2 A, regulated
Size	4 H x 9 W x 8 D, inches
Weight	3 lbs

CONNECTORS: BNC for input and position monitoring. Amphenol 2-Pin Series 80 microphone connector for output to scanner drive coils — Bendix 5-Pin Pygmy Series bayonet connector to scanner transducer.

CONTROLS: Input offset and gain are 10-turn potentiometers with dial counters, on front panel. All other adjustments are 20-turn potentiometers reached through the bottom panel.

PSX-100 POWER SUPPLY

Two independent dual-output regulated power supplies on a 3.5 x 19 inch rack-mount panel.

Output voltage	±15 VDC
Output current, each supply	1.3 A
Regulation, load or line	±0.25%
Ripple	1 mv RMS
Power input	115 VAC, 60 watts, 50-60 Hz
Fuse	1 A, SLO-BLO
Size	3.5 H x 19 W x 8.2 D inches
Weight	11 lbs

CCXY-100 CONTROLLER

Same as CCX-100, except on a 7 x 19 inch rack-mounted panel, and has two sets of circuits to drive two scanners.

Power input	±15 VDC, 2 A, regulated, each circuit
Size	7 H x 19 W x 9 D inches
Weight	7 lbs

CONNECTORS: BNC for input and position monitoring. Amphenol 2-Pin Series 80 microphone connector for output to scanner drive coils — Bendix 5-Pin Pygmy Series bayonet connector to scanner transducer.

CONTROLS: Input offset and gain are 10-turn potentiometers with dial counters, on front panel. All other adjustments are 20-turn potentiometers reached through the bottom panel.

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